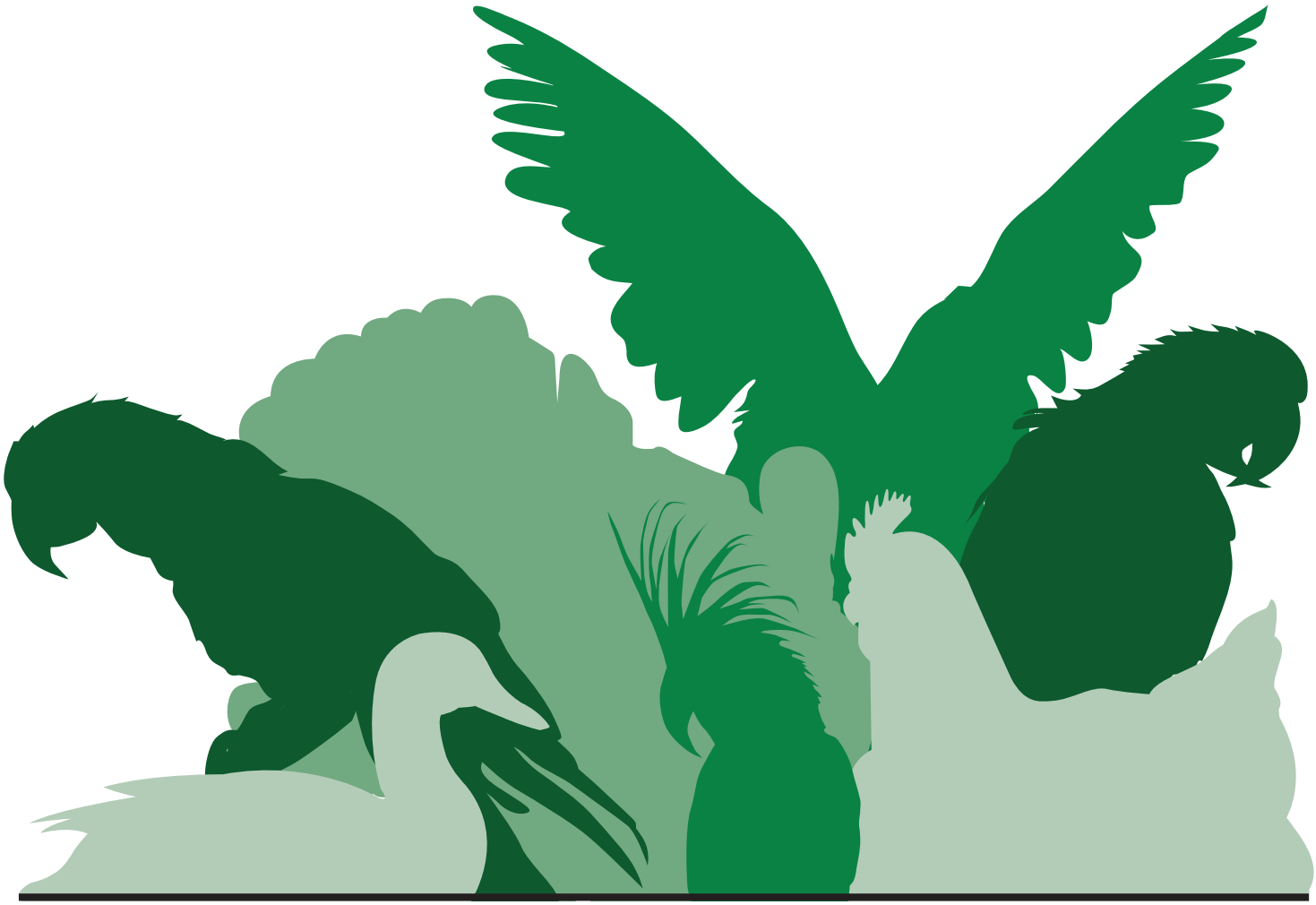
MODULE 6:
EXOTIC AVIAN DISEASES



NATIONAL VETERINARY ACCREDITATION PROGRAM

United States Department of Agriculture • Animal and Plant Health Inspection Service • Veterinary Services

Approved as one unit of supplemental training for participants in USDA's National Veterinary Accreditation Program

the Center for Food Security & Public Health
Iowa State University

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National Veterinary Accreditation Program

Exotic Avian Diseases

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Exotic Avian Diseases

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Learning Objectives

Welcome to the Veterinary Accreditation Exotic Avian Diseases module.

This module consists of two sections that will prepare you to recognize two important diseases that poultry, pet and zoo birds share. First, you will learn some general information that pertains to avian influenza (AI) and exotic Newcastle disease (END). Then you will apply the introductory information to a scenario based on an exotic avian disease case that occurred in the United States.

Upon completion of this module, you should be able to:

- Realize the economic impact of an exotic avian disease outbreak
- Describe the hazards presented by less virulent forms of AI and Newcastle disease viruses
- Recognize the clinical signs associated with high pathogenicity avian influenza (HPAI) and END
- Apply basic biosecurity measures for these diseases
- Report a possible exotic avian disease and understand the investigative process

Completion of this module is estimated to take 45 minutes, but will vary depending on your familiarity with the diseases and information presented.

Introduction

The avian industry in the United States is comprised of the pet bird and commercial poultry industries. From providing companionship to a source of human protein, these groups contribute to the American economy.

Pet Birds

Over 140 veterinarians, board certified in avian practice, along with many more practicing veterinarians, care for the nation's pet bird population. It is estimated that 4% of U.S. households contain pet birds. Mean veterinary care expenditures for the nation's 11.2 million pet birds was $9 per bird; approximately $100.8 million.

Source: 2007 U.S. Pet Ownership and Demographics Sourcebook, American Veterinary Medical Association

Commercial Poultry

The U.S. is the world's second largest exporter of poultry meat and the world's second largest egg producer. In 2009, total farm value of U.S. poultry production exceeded $20 billion. There are over 400 veterinarians involved in the health management of more than 450 million birds in this country.

Sources: Poultry and Eggs Background updated April 2009, USDA Briefing Room, accessed June 8, 2010 at http://www.ers.usda.gov/Briefing/Poultry/Background.htm and USDA Chicken and Eggs Summary 2009, accessed June 8, 2010 at http://usda.mannlib.cornell.edu/usda/current/ChickEgg/ChickEgg-02-25-2010.pdf

Poultry Hobbyists

Poultry hobbyists consist of individuals who keep single birds or backyard flocks for pleasure, meat or egg production, exhibition, breeding or sport.

Avian Diseases

Some avian diseases can be transmitted from pet birds to the commercial poultry industry. Birds kept as companions or raised as a hobby often have less strict biosecurity protocols in place as compared to commercial poultry. Exotic Newcastle disease (END) and high pathogenicity avian influenza (HPAI) are two exotic avian diseases that can be spread on fomites* and by people.

*Fomites are contaminated inanimate objects. For instance, clothing worn while handling pet birds and then into a commercial poultry facility has the potential to harbor disease agents.

Small flocks of backyard poultry used in illegal **cockfighting** have been implicated in the transmission of contagious diseases to commercial poultry operations. Backyard poultry also have contact with wild birds and could introduce disease agents acquired from these birds to commercial flocks.

Exotic Avian Diseases

Exotic avain diseases can be introduced through the **illegal smuggling** of birds into the United States. It is estimated that over 25,000 birds are smuggled in each year. Birds that carry disease agents may appear ill or they may be subclinically infected.

Exotic Newcastle disease (END) and **high pathogenicity avian influenza (HPAI)** are highly contagious foreign animal diseases (FADs) and often fatal in birds. Their clinical signs are indistinguishable from each other. These serious FADs can also resemble some common illnesses seen in poultry and pet birds. Both can cause illness in humans, from mild conjunctivitis with an END infection to severe respiratory disease and death from HPAI. The prompt recognition and control of these diseases is imperative to protect animal and human health.

Newcastle Disease Overview

Newcastle disease viruses are of the serogroup avian paramyxovirus-1 (APMV-1) in the genus *Avulavirus* (family Paramyxovirus).

APMV-1 isolates can be classified as one of three pathotypes, based on their virulence for chickens – **lentogenic** (least virulent), **mesogenic** (moderately virulent), or **velogenic** (most virulent). The milder strains are endemic in the United States. They can also be subdivided into a **neurotropic** form, which is typically associated with respiratory and neurologic signs, and a **viscerotropic** form with hemorrhagic intestinal lesions. These clinical forms overlap and are rarely clear-cut.

Lentogenic
"Mild"
No trade effect

Mesogenic
"Intermediate"
No trade effect

Velogenic
"Severe"
Shut down trade

Newcastle Disease Pathotypes

Lentogenic APMV-1 viruses are common in wild and domesticated birds throughout the world.. These viruses are often carried subclinically, but they sometimes cause mild respiratory disease, decreased egg production and/or weight loss. The mortality rate is usually negligible.

Mesogenic APMV-1 viruses, which are uncommon, are intermediate in virulence. These viruses can cause respiratory signs, decreased egg production and quality, and weight loss. They are occasionally associated with neurological signs, but the mortality rate is relatively low.

Lentogenic and mesogenic viruses can decrease productivity, but do not affect international trade.

Velogenic APMV-1 viruses cause one of the most serious poultry diseases in the world. These viruses are so virulent that, in very susceptible species such as chickens, many birds die before showing any clinical signs. Their presence

in commercial poultry can shut down international trade. Velogenic APMV-1 viruses are absent from domesticated birds in the U.S.

Velogenic APMV-1 viruses are often introduced in imported birds, but they may also arise by mutation from less pathogenic APMV-1 viruses.

Definition of Newcastle Disease

In the U.S., **exotic Newcastle disease (END)** is defined as the viscerotropic velogenic form of the disease. However, all highly pathogenic APMV-1 viruses, including neurotropic velogenic strains, impact international trade and must be reported to the World Organization for Animal Health (OIE)*. For the purposes of this module, END will be the term used for the disease caused by any highly pathogenic (velogenic) APMV-1 virus.

The term END may not be recognized outside the U.S. When filling out an international health certificate, the disease should be referred to as velogenic Newcastle disease (vND).

*The World Organization for Animal Health, formerly known as the Office International des Epizooties or OIE, is the international body that sets standards for important animal diseases ("OIE-listed diseases") affecting international trade. The OIE also collects and disseminates information about disease outbreaks. Nations recognized as free of an OIE-listed disease must report any change in this status to the OIE immediately. END and HPAI are both OIE-listed.

END is highly contagious and has serious consequences for infected poultry. Chickens and some other gallinaceous** birds are very susceptible to this disease; the morbidity and mortality rates can be as high as 100%. Other species of wild and domesticated birds can be mildly to severely affected. A carrier state exists in some birds, particularly psittacine*** species.

**Gallinaceous: Family of birds that includes chickens, turkeys, pheasants, partridges, quail and other related birds.

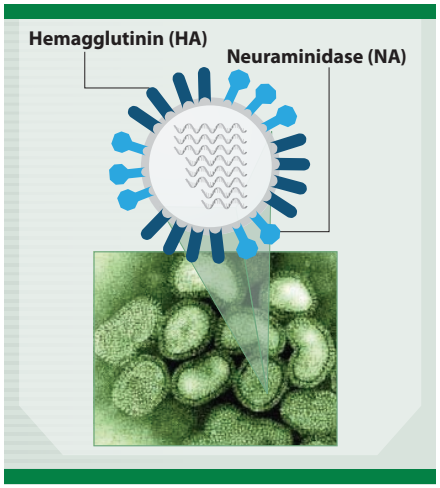
***Psittacine: Family of birds which includes parrots, macaws and parakeets.

Public Health Significance of Newcastle Disease

Humans are the only mammals known to be susceptible to velogenic Newcastle disease (vND). Exposure to large amounts of the virus, typically during vaccination or in the laboratory, has resulted in conjunctivitis. This generally resolves rapidly without treatment but the virus is shed in ocular discharge up to one week; avoiding bird contact during this time is suggested.

For more information, view the Center for Food Security and Public Health (CFSPH) Exotic Newcastle Disease Factsheet at: *http://www.cfsph.iastate.edu/Factsheets/pdfs/newcastle_disease.pdf*

USDA also provides more information about END at: *http://www.aphis.usda.gov/animal_health/birdbiosecurity/end/*



Avian Influenza Disease Overview

Worldwide there are many strains of avian influenza (AI) viruses (genus *influenzavirus A*, family Orthomyxoviridae). Two highly variable surface antigens, the hemagglutinin (H) and neuraminidase (N) proteins, are used to classify AI viruses into subtypes. There are 16 hemagglutinin (H1 to H16) and 9 neuraminidase (N1 to N9) proteins. H5N1 is an example of a subtype. Within a subtype, there are many related and unrelated strains with varying virulence.

AI viruses are classified into two categories, low pathogenicity and high pathogenicity, based on their virulence in chickens and their genetic sequence.

Low pathogenicity avian influenza (LPAI) viruses can replicate only in limited locations (primarily the respiratory and gastrointestinal tracts), and usually cause few or no clinical signs in infected birds.

High pathogenicity avian influenza (HPAI) viruses have changes in the hemagglutinin proteins that allow them to replicate systemically. HPAI viruses typically cause a serious and often fatal disease in chickens and some other birds.

Avian Influenza Subtypes

Only two hemagglutinin variants, H5 and H7, are found in HPAI viruses. The effects of HPAI vary with the species of bird. Although there are exceptions, most of these viruses cause severe disease in chickens and turkeys, but not in waterfowl such as ducks and geese. In susceptible species, morbidity and mortality may approach 100%.

Any AI virus with the genetic characteristics of an HPAI virus is now classified in this group, even if it only causes mild illness. Also important to note is that H5 and H7 LPAI viruses can mutate into HPAI viruses, and outbreaks of any type of avian influenza need prompt attention.

Public Health Significance of High Pathogenicity Avian Influenza

Although many cases of HPAI have been limited to conjunctivitis or mild flu-like signs in people, HPAI can also be a serious zoonotic disease resulting in serious illness and deaths. The first time an AI virus was shown to infect humans occurred in Hong Kong in 1997 when H5N1 hospitalized 18 people and six died of the illness.
Source: Avian Influenza A Virus Infections of Humans, Centers for Disease Control and Prevention accessed January 21, 2011 at http://www.cdc.gov/flu/avian/gen-info/avian-flu-humans.htm

The 2003 outbreak of H7N7 in the Netherlands infected 89 people. Most developed only conjunctivitis, but a few people had influenza symptoms and one veterinarian became severely ill and died.

The most significant HPAI outbreak affecting humans to date began in 2003. H5N1 emerged in Southeast Asia and as of December 29, 2010, 512 confirmed human cases had been reported to the World Health Organization; 304 of these cases were fatal. Most of these infections have been reported from Asia and Egypt, and a few cases have also been confirmed in Africa, Azerbaijan, the Middle East and Turkey. There are fears that an avian H5N1 virus could eventually become adapted to humans, resulting in a severe human pandemic. Updated human statistics can be found at The World Health Organization website at: *http://www.who.int/csr/disease/avian_influenza/country/en/*

For more information, view the CFSPH High Pathogenicity Avian Influenza Factsheet at: *http://www.cfsph.iastate.edu/Factsheets/pdfs/highly_pathogenic_avian_influenza.pdf*

USDA also provides more information about avian influenza at: *http://www.aphis.usda.gov/animal_health/birdbiosecurity/AI/*

Knowledge Review #1

Which of the following are true statements about avian influenza or Newcastle disease viruses? Select <u>all</u> correct statements.

- **A.** Newcastle disease infections in birds will always result in severe illness and high mortality rates.
- **B.** Newcastle disease pathotypes are classified based on their virulence in chickens.
- **C.** Avian influenza infections in birds will always result in severe illness and high mortality rates.
- **D.** Influenza A viruses are classified into subtypes based on two surface antigens, the hemagglutinin (H) and neuraminidase (N) proteins.
- **E.** There are virulent forms of avian influenza and Newcastle disease that have public health consequences.

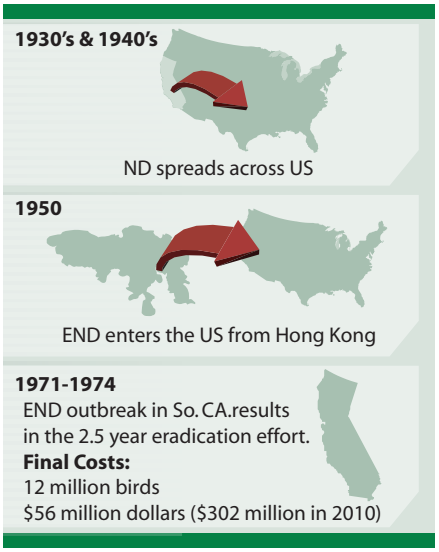
Answers are found in the appendix.

History of Exotic Newcastle Disease

Newcastle disease was discovered in 1926, at Newcastle-on-Tyne, England and in Java, an island in Indonesia. These outbreaks were caused by highly virulent (velogenic) viruses. Several panzootics* followed. The first, which began in 1926, spread very slowly. Later outbreaks spread much more rapidly, because transportation of animals and people had become more efficient.

*A panzootic is an outbreak of infectious disease in animals that spreads across a large region (several countries, a continent, even worldwide). Referred to as a pandemic in humans.

Milder forms of Newcastle disease, caused by mesogenic and lentogenic strains, were discovered later. Such forms were first recognized in the United States in the 1930s, with outbreaks of pneumoencephalitis in California. By the mid-1940s, the disease had spread across the United States.

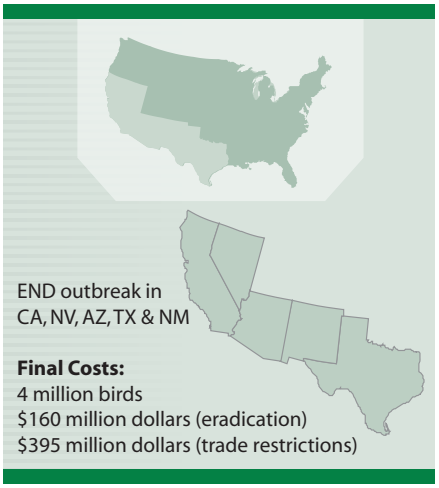


The first reported cases of **exotic Newcastle disease (END)** in the United States appeared in 1950 and occurred in partridges and pheasants that were imported from Hong Kong. The disease spread to five farms, but it was quickly eliminated by destroying the infected birds.

In 1971, a major outbreak of END occurred in commercial poultry flocks in southern California after the arrival of infected pet birds from Latin America. It took nearly 2 1/2 years to eradicate the disease, and almost 12 million birds were destroyed on over 1,300 premises. At the time, the eradication effort cost taxpayers approximately $56 million (which corresponds to approximately $302 million dollars in 2010).

In October 2002, END was confirmed in the State of California. Subsequently, the disease spread into Nevada, Arizona, Texas, and New Mexico. The spread of the disease was due in part to **illegal cockfighting**. Approximately 4 million birds on 2,701 premises had to be depopulated.

Eradication efforts surrounding this outbreak cost taxpayers $160 million. The impact from trade restrictions was estimated at $395 million, which included the direct costs of lost exports along with additional indirect costs.



Global Impact of END

The global impact of END is enormous. In **developed** countries, outbreaks of END are extremely costly to eradicate in order to minimize international trade losses. Control measures, including vaccination, are also a continuing economic loss. Countries free of END are faced with repeated testing to maintain that status for trade purposes.

In **developing** countries with endemic END, this disease limits the development of a well-established commercial poultry industry and creating sustainable trade links. Many developing countries also rely on village chickens to supply a significant portion of dietary protein in the form of eggs and meat, especially for women and children. Continued losses from END directly affect the quantity and quality of the food for people living on marginal diets.

History of Avian Influenza

Avian influenza was first identified in Italy, during a high pathogenicity avian influenza (HPAI) epizootic* in 1878. The first HPAI outbreak in the United States was reported in 1924. Between 1901 and 1930, the disease was also documented in Europe, North and South America, Egypt, China and Japan. Since that time, outbreaks have occurred sporadically in many countries throughout the world. Since the early 2000s, H5N1 (HPAI) viruses have

become established in Asia and Egypt. These viruses have caused repeated, severe epizootics in that region and, in some cases, have spread to other continents.

*Epizootic is an outbreak among animals that occurs at a particular time but does not persist.

Economic losses from avian influenza vary depending on the strain of virus, species of bird infected, number of farms involved, density of poultry populations, control methods used and the speed of implementation of control or eradication strategies.

Even under favorable conditions, **outbreaks of HPAI** can be extremely **difficult to control**.

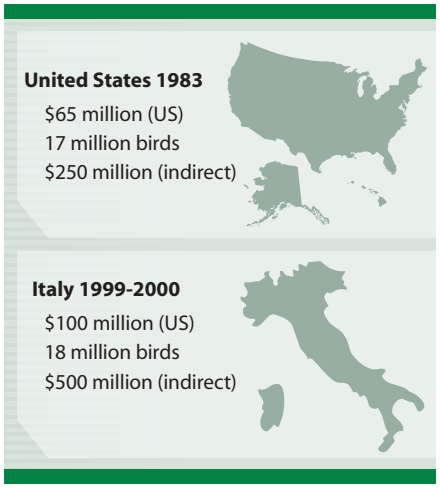
Economic Impact of HPAI

Direct economic losses due to an HPAI outbreak include the costs of depopulation, disposal, cleaning, disinfection, quarantines and surveillance, as well as indemnities paid for the elimination of birds, production losses, and damage to the economy from trade restrictions.

Indirect losses result from things such as lost wages, reduced commerce, lower prices for poultry products due to increased supply in domestic markets, higher prices for consumers in countries no longer receiving U.S. product, decreased tourism, and the cost of purchasing replacement animals.

In 1983, an outbreak of high pathogenicity avian influenza (H5N2) in the northeastern **United States** took 2 years to control. This outbreak resulted in the destruction of more than 17 million birds and direct losses totaling nearly $65 million (which corresponds to approximately $143 million dollars in 2010). A 30% increase in retail egg prices and indirect costs estimated at more than $250 million ($549 million in 2010) were also reported.

Outbreaks in other countries have also been costly. In the 1999-2000 outbreak of HPAI (H7N1) in **Italy**, the government paid farmers $100 million (USD) in compensation for 18 million birds (which corresponds to approximately $129 million dollars in 2010). Total indirect losses were estimated at $500 million (USD) ($656 million in 2010).



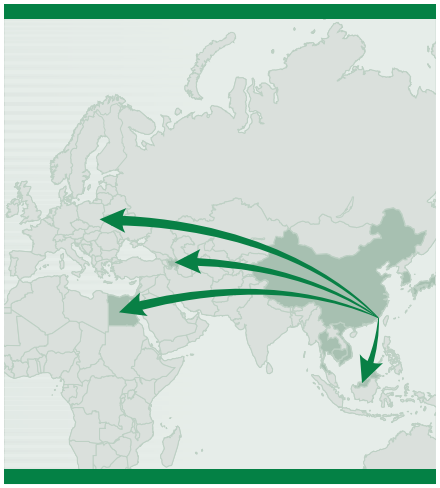
Global Impact of HPAI

Globally the most important HPAI viruses are the Asian lineage H5N1 viruses. These viruses caused outbreaks among poultry in Hong Kong in the late 1990s.

The 2003 outbreak of high pathogenicity avian influenza (H7N7) in the **Netherlands**, which spread to Germany and Belgium, resulted in the destruction of 30 million birds in the Netherlands – a quarter of the nation's poultry stock.

In 2003, H5N1 viruses emerged in Southeast Asia and caused widespread outbreaks among domesticated poultry. These viruses eventually spread into domesticated or wild birds in other regions of Asia, and have also affected parts of Europe, the Pacific, the Middle East and Africa. Although some countries have eradicated Asian lineage H5N1 viruses from their domesticated poultry, this epizootic is ongoing and worldwide eradication is not expected in the short term.

The Asian lineage H5N1 viruses have also caused disease in other mammals including various large felids, housecats, dogs, palm civets, stone martens, mink and raccoon dogs. These viruses have been detected in domesticated pigs and wild pikas, and experimental infections have been established in foxes, ferrets, rodents and rabbits. Their full host range may still be unknown. Asian lineage H5N1 (HPAI) viruses have been found in many species of wild birds, which is unusual. Some of these birds have been severely affected.



The cost of eradication and lost trade can reach millions of dollars from a small, controlled outbreak with only regionalized exports banned. In a larger outbreak, this figure could reach into the billions of dollars.

North American HPAI Outbreaks

The last outbreak of HPAI (H5N2) in Mexico occurred in 1995, but related low pathogenicity (LPAI) viruses have not been entirely eliminated from the country. These viruses persist despite years of vaccination and eradication efforts.

Canada reported its first outbreak of HPAI to the OIE in 2004. This H7N3 virus was probably introduced into a poultry flock, in the LPAI form, from wild birds in British Columbia. It was linked to two cases of conjunctivitis and flu-like illness in people, with several other suspected but unconfirmed cases. In 2007, a different H7N3 virus caused an HPAI outbreak in Saskatchewan. It also seems to have come from wild birds.

In the **United States**, no HPAI outbreaks were reported for approximately 20 years after the 1983 epizootic in Pennsylvania. In 2004, an H5N2 HPAI virus was isolated from a Texas broiler chicken flock that supplied live bird markets. This virus did not cause severe disease when tested in chickens, but its genetic makeup suggested it could. For this reason, it was classified as an HPAI virus and the flock was depopulated.

United States LPAI Outbreaks

LPAI viruses cause little or no illness and they may not be detected unless the flock is tested regularly for AI viruses. Since the birds develop immunity to the LPAI viruses, related HPAI viruses that arise may cause less obvious clinical signs. Prompt control of LPAI cases is necessary to decrease the likelihood of HPAI outbreaks. The U.S. has identified several H5 and H7 LPAI outbreaks since 2004 affecting turkeys, broilers, upland game birds, breeding stock, and backyard flocks. In each case, the flocks were depopulated and indemnity and response costs paid. These outbreaks illustrate the hazards of H5 and H7 LPAI viruses in poultry flocks.

Knowledge Review #2

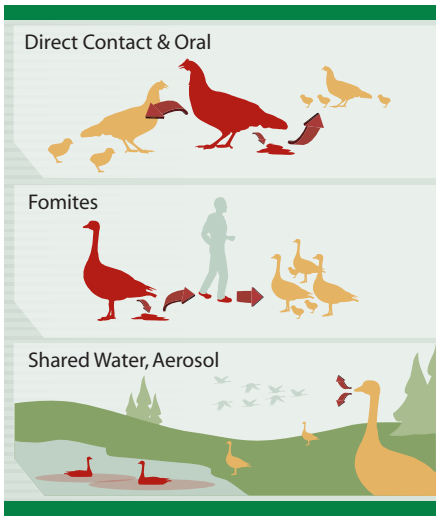
Which of the following are immediate economic impacts associated with an outbreak of HPAI or END? Select ALL that apply.

- **A.** Costs associated with depopulating and disposing of animals.
- **B.** Costs associated with indemnifying owners.
- **C.** Cost of increased disease surveillance.
- **D.** Reduced ability to export poultry and poultry products.
- **E.** Higher prices for domestic poultry products.
- **F.** Higher prices for poultry products in other countries.

Answers are found in the appendix.

END and HPAI Disease Information

Both END and HPAI are highly contagious, often fatal diseases that are CLINICALLY INDISTINGUISHABLE from each other. Mortality rates can be up to 100% for both diseases.



Transmission

END and HPAI are spread through **direct contact** with infected birds, by **oral** consumption of the virus (often from feces or a contaminated water source), on **fomites**, and by **aerosol** droplets from respiratory secretions.

Clinical Signs

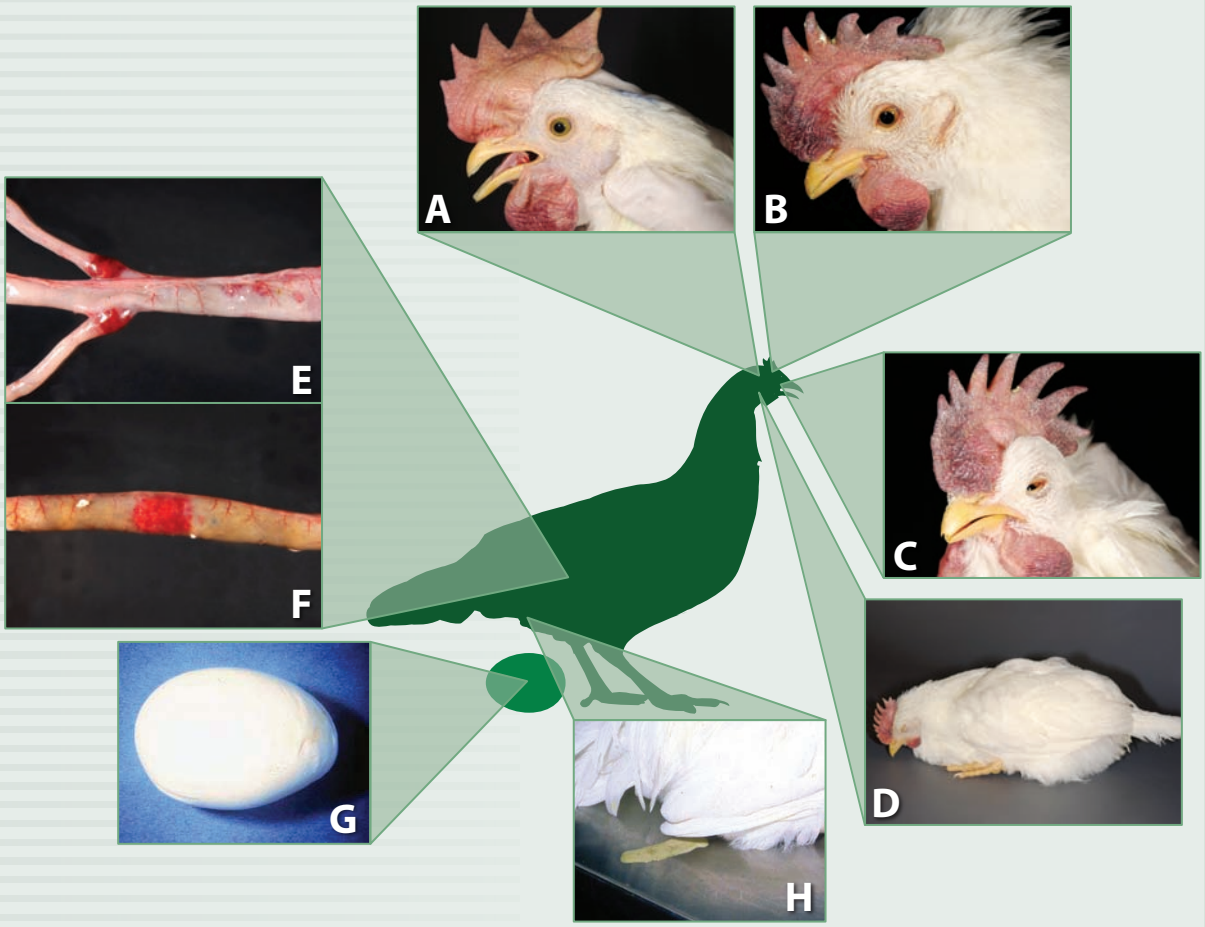
- Respiratory: Coughing, sneezing, nasal discharge (+/- blood tinged), dyspnea, cyanosis
- Nervous: Depression, ataxia, torticollis*
  - *Torticollis means a contraction, often spasmodic, of the muscles of the neck, chiefly those supplied by the spinal accessory nerve,

which results in the head being drawn to one side. Also commonly referred to as “wry neck”.

- Digestive: Watery diarrhea, decreased food and water consumption, blood-tinged oral discharges
- Other: Sudden death without clinical signs, subcutaneous petechial and ecchymotic hemorrhages, decreased egg production, thin-shelled or misshapen eggs, and swelling of the head, eyelids, comb, wattles, and hocks.

The next section has photos of the clinical signs in both poultry and pet birds. For more information about END and HPAI, please see the appendix for the END and HPAI Reference Chart and Disease Briefs for both diseases.

HPAI and END Clinical Signs – Poultry

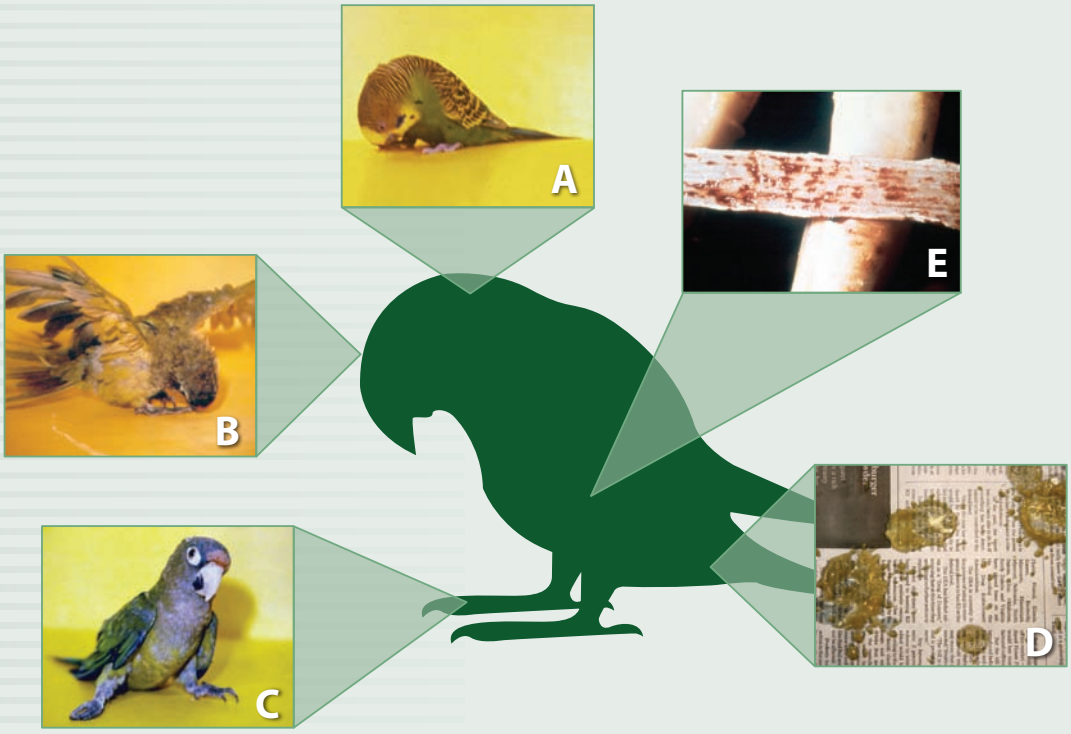


HPAI and END Clinical Signs - Poultry

- **A.** Sneezing, gasping for air, nasal discharge, and coughing
- **B.** Cyanosis of the wattle, comb, and legs. Swelling of the head, eyelids, comb, and wattle
- **C.** Swelling of tissues around eyes and neck
- **D.** Depression, muscular tremors, drooping wings, twisting of head and neck, circling, and complete paralysis
- **E.** Hemorrhagic lesions of the gastrointestinal tract
- **F.** Hemorrhagic lesions of the gastrointestinal tract
- **G.** Decreased egg production, soft-shelled or misshapen eggs
- **H.** Greenish, watery diarrhea

If you identify any of these signs and a suspicious history, call your State Animal Health Official, your state veterinary diagnostic laboratory, or USDA’s toll free number at 1-866-536-7593 for a local contact.

HPAI and END Clinical Signs - Pet Birds



HPAI and END Clinical Signs - Pet Birds

A. Depression
B. Incoordination
C. Leg paralysis
D. Watery diarrhea
E. Hemorrhagic lesions of the gastrointestinal tract

If you identify any of these signs and a suspicious history, call your State Animal Health Official, your state veterinary diagnostic laboratory, or USDA's toll free number at 1-866-536-7593 for a local contact.

Differential Diagnoses

As mentioned previously, END and HPAI are **CLINICALLY INDISTINGUISHABLE** from each other.

Other diseases of pet birds and poultry also share some of the same clinical signs and would be included on a different differential list. The handout, "Differential Diagnoses for END/HPAI", provides the same details as covered here, and is available in the appendix.

In Poultry:

Fowl cholera is a contagious bacterial disease of domesticated and wild avian species. It is caused by infection with Pasteurella multocida. A fulminating bacteremia with high morbidity and mortality often results. Acute disease can result in fever, anorexia, ruffled feathers, diarrhea, increased respiratory rate and sudden death. Chronic forms of the disease cause localized infections of the skeletal system. Diagnostic tests include blood smear and culture. Certain strains of fowl cholera are reportable to OIE – contact your State Animal Health Official.

Fowl pox is a relatively slow spreading viral infection caused by an avipoxvirus and is found throughout the world. It affects chickens, turkeys and other domestic fowl. The virus can survive in dried scabs and for months on

contaminated premises under certain conditions. There are two common forms of fowl pox, referred to as the dry and wet (or diphtheritic) forms. The **dry form** is characterized by the presence of scab-like lesions on the skin; this form is not a differential for END/HPAI. In the **wet form**, the lesions are seen on mucosal surfaces, such as the conjunctiva of the eye, nasal passages, oral and pharyngeal mucosa, and the mucosa of the trachea. The wet form is more severe clinically, causing interference with eating or breathing and resulting in death due to asphyxiation when the trachea is affected. Diagnostic tests include histopathology, tissue smear, virus isolation, and PCR.

Infectious coryza is caused by the bacterium *Avibacterium* (formerly *Haemophilus*) *paragallinarum*, which primarily attacks the upper respiratory system and nasal passages. It primarily affects chickens causing swelling of the face, wheezing, sneezing, nasal discharge, conjunctivitis and open-mouth breathing. Infectious coryza can be acute or chronic in nature. The acute cases spread rapidly and death can occur within hours to days of the first signs. Chronic carriers serve as reservoirs of infection for poultry flocks. Diagnostic tests include bacteriology to identify the catalase-negative organism and PCR.

Infectious laryngotracheitis (ILT) is an acute respiratory disease caused by a herpesvirus. It primarily affects chickens but can also occur in turkeys and game birds. The virus can survive for long periods in recovered birds and in the environment. Signs can vary from a mild respiratory disease to the sudden occurrence of gasping, swollen watery eyes, coughing, wheezing, expulsion of blood from the mouth and nostrils, head shaking, elevated mortality, reduced feed consumption, and decreased egg production. Diagnostic tests include necropsy with blood/mucus/ caseous exudate or hollow cast in trachea, virus isolation, tissue culture, histopathology, and PCR. Certain strains of ILT are reportable to OIE – contact your State Animal Health Official.

Mycoplasmosis—Several *Mycoplasma* species have been isolated from avian hosts. The most important are *Mycoplasma gallisepticum*, *M. synoviae*, *M. meleagridis* and *M. iowae*. *Mycoplasmas* are a group of microorganisms that are half way between bacteria and viruses, in that they have some of the properties of each. *M. gallisepticum* causes disease in chickens, turkeys, gamebirds and house finches. *Mycoplasmas* are associated with infections of the respiratory, joint, and reproductive systems and clinical signs can mimic signs of HPAI or END. Diagnostic tests include ELISA, isolation and identification, PCR or hemagluttination-inhibition. Certain strains of *M. gallisepticum* are reportable to OIE – contact your State Animal Health Official.

Infectious bronchitis (IB) is an acute, highly contagious viral respiratory disease of chickens, caused by a coronavirus. It is characterized by respiratory signs (e.g., coughing and sneezing), drop in egg production, decreased egg quality, nephritis, and morbidity. Mortality rates can reach 40% in chickens less than three-weeks old, but over five-weeks, it is less significant. Diagnostic tests include clinical history, seroconversion or rising viral antibody titers, hemagluttination inhibition test, and virus isolation. Certain strains of IB are reportable to OIE – contact your State Animal Health Official.

Low pathogenicity avian influenza (LPAI) viruses usually cause inapparent infections or mild disease; more severe illness can occur in birds that are co-infected with other pathogens. Diagnostic tests include virus isolation, PCR, agar gel immunodiffusion (AGID), and serology. This is a zoonotic and an OIE Reportable Disease - contact your State Animal Health Official.

Management problems such as deprivation of water, feed or poor ventilation.

In Psittacines:

Aspergillosis is a common cause of opportunistic respiratory disease in companion birds caused by the bacteria *Aspergillus* spp. Susceptibility increases with stress, poor management, use of antibiotics or steroids, respiratory irritants, and concomitant disease. Clinical signs include weight loss, depression, respiratory distress, and occasionally neuromuscular abnormalities. In acute overwhelming infections, dyspnea or sudden death is observed. Diagnostic tests include CBC and chemistry panel, radiographs, cytology, swabs from cloaca/choanal/ oropharyngeal/conjunctiva/fecal, immunohistochemistry, ELISA, or PCR. This disease is zoonotic.

Pacheco's disease is a herpesvirus affecting only psittacine birds. Asymptomatic carriers exist and may shed virus in their feces when stressed. The most common clinical sign is sudden death or death after a very brief illness in birds in excellent body condition. Clinical signs can consist of lethargy, depression, anorexia, diarrhea, conjunctivitis, and central nervous system signs including tremors, ataxia, opisthotonos, and seizures. Diagnostic tests include CBC, serum electrophoresis, cytology, and fungal culture.

In All Avian Species:

Avian chlamydiosis is caused by *Chlamydophila* (formerly *Chlamydia*) *psittaci*, a gram negative, intracellular bacterial parasite that can occur in most species of birds. In humans, infection with *Chlamydophila* is called psittacosis; infection in birds is termed avian chlamydiosis. Clinical signs in poultry can include depression, ruffled feathers, weakness, anorexia, respiratory distress, diarrhea, conjunctivitis, and decreased egg production. In pet birds, common signs include anorexia, weight loss, diarrhea, respiratory distress, central nervous system signs, and conjunctivitis. Diagnostic tests include CBC, chemistry panel, radiographs, impression smears with staining, immunohistochemistry, ELISA, and PCR. This is a zoonotic and an OIE Reportable Disease - contact your State Animal Health Official.

Calcium deficiency is most common in young birds of uncertain etiology. However, affected birds are often on diets deficient in calcium, phosphorus or vitamin D3. Clinical signs include seizures, ataxia, opisthotonos, weakness or tetany. In adults, osteoporosis and reduced egg shell quality occur. Diagnostic tests include CBC and chemistry panel.

Encephalomalacia is a nutritional disease caused by deficiencies of vitamin E and selenium in the diet. It can cause a wide variety of clinical signs in birds of all ages including ataxia, head tilt, poor digestion, lethargy or hyperactivity, tremors, incoordination, and recumbency. Diagnostic tests include a necropsy with histopathology of the brain.

Severe parasitism—Birds can become infected with a variety of internal and external parasites and protozoa including ascarids, cestodes, *Cryptosporidium* spp., coccidia, *Toxoplasma* spp., and trematodes. Generalized symptoms of parasitism can include anorexia, weight loss, diarrhea, vomiting, dehydration, central nervous system signs (*Baylisascaris procyonis*), coughing and dyspnea (cryptosporidiosis), paralysis and blindness (toxoplasmosis). Diagnostic tests include fecal smear or float or identifying in tissue(s). Some parasites carry zoonotic diseases; screwworms are a foreign animal and an OIE Reportable Disease.

Salmonellosis—In pet birds, infection with the bacteria *Salmonella* spp. can lead to acute disease with nonspecific signs including lethargy, anorexia, polydipsia, polyuria, and diarrhea. In chronic cases, central nervous system signs, arthritis, dyspnea and indications of liver, spleen, kidney, or heart damage are common. With high dose infections, conjunctivitis may occur. Free-ranging birds can be subclinical carriers. Diagnostic tests include serology and bacteriology to identify the organism. This is a zoonotic disease and may be reportable in some states - contact your State Animal Health Official.

Toxicosis—Lead and zinc ingestion are two of the most common and clinically recognized poisonings of companion birds and captive and free-ranging birds. The precise cause of lead intoxication in many cases is undetermined. Clinical signs may include lethargy, depression, anorexia, weakness (wing droop, leg paresis), diarrhea, ataxia, head tilt, blindness, circling, paresis, paralysis, head tremors, convulsions, and death. Some birds may die with no clinical signs. Diagnostic tests include CBC/chemistry panel, radiographs and serum lead and zinc levels.

For quick reference, see the document in the appendix titled, "HPAI, END Differentials – Reportable and Diagnostics".

Diagnosis

If END or HPAI are suspected, State and/or Federal animal health officials should be contacted IMMEDIATELY.

A Foreign Animal Disease Diagnostician (FADD) will likely be assigned to obtain samples and submit them to an authorized laboratory. Virus isolation is required for a definitive diagnosis of END or HPAI.

Diagnosis of an exotic avian disease requires laboratory testing at the USDA National Veterinary Services Laboratories (NVSL). The NVSL is composed of 4 testing laboratories, three of which are located in Ames, Iowa. The fourth laboratory is the Foreign Animal Disease Diagnostic Laboratory which is located on Plum Island, New York. In general, the Area Veterinarian-in-Charge (AVIC) authorizes submissions of United States-origin samples to the NVSL. All exotic avian disease samples are sent to Ames, IA. This diagnostic testing is a free service and incurs no cost to either the owner or local veterinarian.

Because these diseases are so highly contagious and the impact of an outbreak so severe, biosecurity is very important to prevent disease spread. The next sections will address biosecurity for pet bird enthusiasts as well as the poultry industry.

Biosecurity for Pet Birds

END and HPAI are disease threats to the caged-bird industry and poultry hobbyists. In order to best protect avian populations, individuals in the pet bird industry should:

- **Maintain records** of all sales and shipments of flocks
- **Quarantine** all newly introduced (purchased or acquired) birds for at least 30 days
- **Restrict movement** of personnel between new (quarantined) and old birds
- **Require strict sanitation** of personnel and/or equipment that is shared between new (quarantined) and old birds

Birds illegally smuggled into the United States that are not quarantined and tested by the USDA may carry infectious diseases. Individuals importing birds must request certification from suppliers that birds are:

- **Legally imported** or are from U.S. stock,
- **Healthy** prior to shipment, and
- **Transported in new** or thoroughly disinfected containers.

Biosecurity for Commercial Poultry

Good management and biosecurity practices are of the utmost importance to the commercial poultry industry. Essentials of good biosecurity practices should include:

- Only allowing essential workers and vehicles on the premises.
- Providing clean clothing/footwear and changing or shower facilities and footwear disinfection for employees.
- Cleaning and disinfecting contaminated vehicles entering and leaving the premises.
- Avoid loaning or borrowing equipment or vehicles from other farms.
- Personnel should avoid visiting other poultry operations including live-bird markets.
- Maintaining an "all-in, all-out" philosophy of flock management with a single-age flock.
- Preventing poultry flocks from coming into contact with wild or migratory birds.
- Avoid bringing birds from live-bird markets back to the farm.
- Avoid keeping pet birds on the farm. Employing workers who own pet birds exposes poultry to increased disease risk; advise accordingly.
- Working with a veterinarian to submit diseased birds to a veterinary diagnostic laboratory for examination.

Disinfection

The table lists the disinfectants that have effectiveness against END and/or HPAI.

Exotic Newcastle Disease (END)	Highly Pathogenic Avian Influenza (HPAI)
Sodium hypochlorite (6%), phenolics (e.g., One-Stroke Environ®), oxidizing agents (e.g., Virkon® S) and quaternary ammonium compounds (e.g., Roccal®-D Plus)	
Inactivated by heating to 133°F for 3 hours or 140°F for 30 minutes	Inactivated by heating to 133°F for 60 minutes
pH = 3 inactivates	pH = 2 inactivates
Formalin – efficacy is temperature dependent	Aldehydes (formalin, gluteraldehyde, formaldehyde)
Chlorhexidine (Nolvasan® S), ether	70% ethanol, povidone-iodine, lipid solvents

Scenario Introduction

You are a small animal veterinarian with an interest in avian and exotic animal medicine. Your interest and clinical experience in birds is becoming known in the area. You are seeing more cases every month and are enjoying this new practice builder.

A new client, Mr. Jones, called this morning to make an appointment. He owns one of the two pet bird shops in town and you look forward to referrals from his business.

You are booked up, but squeeze him in with his two young Amazons that have diarrhea.

History

Mr. Jones arrives for his appointment and you begin by taking a patient history.

You ask, "How long have you had the birds?" Mr. Jones replies, "I picked them up about two weeks ago."

"How long have they been sick?" you inquire. "They have been sick almost a week," he replies.

You ask, "Are any of your other birds affected?" Mr. Jones answers, "All the other birds are fine."

"What are you feeding them?" Mr. Jones explains, "I use a pelleted bird food along with fresh fruits and vegetables."

You ask, "How would you describe their environment?" Mr. Jones replies, "They are both kept in one large wire cage. My shop is very clean, with good ventilation and the birds are well taken care of."

"Where do you get your birds?" you inquire. "I am part of a chain and my parent company handles the inventory," he replies.

You pose one last question, "Have the birds received any vaccinations?" Mr. Jones responds, "No, not that I know of."

Physical Exam

Upon physical exam, you observe well fleshed birds with diarrhea, fluffed feathers, and mild coughing. The birds seem mildly depressed and mildly dehydrated. You begin to think about rule outs.

Knowledge Review #3

Select all possible differentials based on the information presented.

- **A.** Aspergillosis
- **B.** Avian Chlamydiosis
- **C.** Calcium Deficiency
- **D.** Encephalomalacia
- **E.** Exotic Newcastle Disease
- **F.** High Pathogenicity Avian Influenza
- **G.** Lead Toxicity
- **H.** Pacheco's Disease
- **I.** Parasitism
- **J.** Salmonellosis
- **K.** Systemic Organ Disease

Answers are found in the appendix.

Treatment

You take blood to run a CBC and chemistry panel as well as feces for a float/smear/culture.

While waiting for your results, you give the birds subcutaneous fluids and start them on antibiotics and vitamins.

You send the owner and birds back to the pet store while waiting for results.

Next Day

The next day Mr. Jones calls in a panic. One of the sick birds has died and now several other birds in his shop are acting sick as well. Some birds are now showing neurological signs.

Mr. Jones is overwhelmed with work as one of his weekend employees, Jason, just quit. Jason had a lot of experience as his family raises chickens in a backyard flock.

Further Investigation

Your differential list is narrowing as you now suspect this is an infectious disease. You question Mr. Jones further regarding the source of the birds and he reluctantly tells you that, although he normally gets all his birds from the parent company, these last two came from a friend in the business for a "great price". You also learn that these birds were not separated from the other birds upon arrival.

Knowledge Review #4

What is the recommended period of time to quarantine newly purchased or acquired birds?

- **A.** 7 days
- **B.** 14 days
- **C.** 21 days
- **D.** 30 days

Answers are found in the appendix.

Second Exam

Mr. Jones brings in one of the sick birds for physical examination and the dead bird for a necropsy. You examine the moribund bird and observe a pasty vent, difficulty breathing, mild torticollis*, and petechial hemorrhages on the shanks.

*Torticollis means a contraction, often spasmodic, of the muscles of the neck, chiefly those supplied by the spinal accessory nerve, which results in the head being drawn to one side. Also commonly referred to as "wry neck".

Knowledge Review #5

After examining this second sick bird, you take a moment to go over what is known about this case. The disease appears to be spreading throughout the bird shop, the birds were acquired illegally, and one has already died. What should your next step be?

- **A.** Ask Mr. Jones to leave the birds with you for the day so you can catch up on the rest of your appointments
- **B.** Necropsy the bird and prepare tissue samples for shipment to the closest diagnostic laboratory.
- **C.** Contact your state or federal animal health official immediately.
- **D.** Go home for lunch so that you can research this more and contemplate it further.

Answers are found in the appendix.

Definitive Diagnosis

Both the State Animal Health Official and APHIS Area Veterinarian-in-Charge (AVIC) have access to trained Foreign Animal Disease Diagnosticians (FADD) in the area that can move this investigation forward. An FADD is sent to your clinic and performs the necropsy. The necropsy revealed **hemorrhagic lesions** in the intestines and **edema** of the submandibular region.

The FADD packages and sends the samples to the National Veterinary Services Laboratories in Ames, IA as this is a suspicious foreign animal disease in an avian species. The laboratory isolates **Exotic Newcastle Disease (END)** virus in lung tissue from the dead parrot and in the cloacal swabs from the sick bird.

Knowledge Review #6

Your clinic, as well as Mr. Jones' pet bird shop, are contaminated and serve as potential sites for the spread of END. It is likely that the State Animal Health Official will enforce a quarantine on the sites until they can be properly cleaned and disinfected. What disinfectants would be effective in this process? Select ALL that apply.

- **A.** Soap and water
- **B.** Chlorhexidine (Nolvasan® S)
- **C.** Quaternary ammonium compounds (Roccal®-D Plus)
- **D.** Oxidizing agents (Virkon® S)
- **E.** Sodium hypochlorite 6% (bleach)

Answers are found in the appendix.

Knowledge Review #7

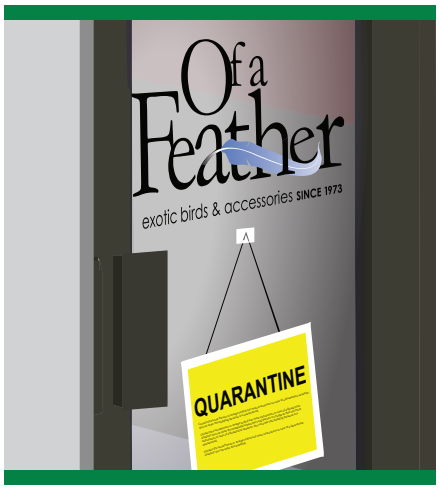
You remember that Jason, Mr. Jones' former employee has backyard chickens and discover that they have a family friend who works for a local poultry operation. You have also heard that illegal cock fighting goes on in the county. What course of action should you take?

- **A.** Talk to Mr. Jones and get Jason's contact information to inform him of the risk.
- **B.** Contact all of your bird clients and inform them of the disease risk.
- **C.** Share this information with the state and/or federal animal health official.

Answers are found in the appendix.

Final Investigation Report

Since the definitive diagnosis was Exotic Newcastle Disease, your veterinary clinic and the pet bird shop were quarantined, and all sick and contact birds were euthanized.



Findings from the investigation of this case would suggest that the virus was introduced by the young parrots purchased from a questionable source. The fact that the seller could not be located after the sale would suggest that the birds may have been smuggled into the United States.

Trace-back surveillance by state and federal officials of all birds sold during the estimated time that the virus may have been present in the pet store did not detect any other positive birds, nor from any of your clients that were in the clinic on the day Mr. Jones was there. Because there were no other reports of problems in pet birds in this and other states, it was concluded that this was an isolated introduction of Exotic Newcastle Disease.

Conclusion

Due to prompt recognition, diagnostic testing, and involvement of the authorities, this outbreak was limited in its scope, unlike the 2002 outbreak, where millions of birds had to be destroyed due to END.

As a practitioner in the U.S., you are on the front lines of defense against foreign animal and zoonotic diseases. Your recognition of and prompt response to potential exotic avian diseases are essential to the livelihood of poultry producers and bird owners nationwide, and to public health given the zoonotic nature of HPAI.

Summary

This module described the economic impact of exotic avian disease outbreaks. As a practitioner in the U.S., you now have the tools to understand the differences in the types of avian influenza viruses as well as Newcastle disease viruses. When clinical signs present themselves in pet birds or poultry, you should be able to promptly recognize them, report your suspicions to the state or federal animal health officials and implement biosecurity measures to limit disease spread.

Supplemental Training

The content in this module has been approved expressly to serve as one unit of supplemental training for participants in USDA's National Veterinary Accreditation Program. Please ensure you complete, sign, and retain the certificate that was issued with this document stating that you have read the contents of this module. This certificate will be your only proof of having completed this module, and will need to be provided to the appropriate official should APHIS audit your accreditation supplemental training records in the future. Contact your VS Area Office for more details on accreditation renewal.

Acknowledgements

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Photo and Illustation Credits

Page 1 The top photo depicts three pet birds (breed: Quaker) in a metal cage. The bottom photo depicts a flock of white turkeys. These photos depict the variation in the avian industry. *Photo sources: USDA (top), Lara Durben, Minnesota Turkey Growers Association (bottom)*

Page 2 ***(Top)*** The top photo shows a gamefighting cock in a ring. The bottom photo is of someone who smuggled birds into the United States illegally and was detained upon entry. *Photo sources: iStockphoto.com (top), USDA (bottom)*

(Bottom) This illustration depicts the various pathotypes of exotic Newcastle disease and their effect on trade. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 3 ***(Top)*** This is a photo of a person with conjunctivitis, which is a sequellae to exposure to END virus without wearing the proper personal protective equipment. *Photo source: Joe Miller, Centers for Disease Control and Prevention, Public Health Image Library*

(Bottom) This graphic shows both a diagram and a photo of the avian influenza virus. *Graphic illustration by: Dani Ausen, Iowa State University; Photo source: University of Georgia, Athens*

Page 4 The top photo depicts chickens with torticollis, which is a clinical sign of HPAI and causes a contraction of the neck muscles. The bottom photo depicts ducks, which do not usually experience clinical disease due to HPAI. *Photo sources: Dennis Senne, USDA (top); Danelle Bickett-Weddle, Iowa State University (bottom)*

Page 5 ***(Top)*** This graphic illustrates the occurrence of various Newcastle Disease (ND) and Exotic Newcastle Disease (END) outbreaks. The top image depicts the ND outbreak that started in California in 1930 and spread across the United States in the 1940's. The middle graphic is from the 1950 END outbreak in Hong Kong and how it spread to the United States. The bottom image is the 1971 to 1974 outbreak of END in southern California that took 2.5 years to eradicate at a final cost of 12 million birds and $56 million dollars ($302 million dollars in 2010). *Graphic illustration by: Clint May, Iowa State University*

(Center) This graphic depicts the Exotic Newcastle Disease (END) outbreak in 2002 that started in California and spread to the southwestern states of Nevada, Arizona, Texas, and New Mexico. Eradication efforts depopulated 4 million birds and cost $160 million dollars. Trade restrictions cost an estimated $395 million. *Graphic illustration by: Clint May, Iowa State University*

(Bottom) This game cock is being placed into a basket. *Photo source: FAO*

Page 6 ***(Top)*** This illustration depicts the economic losses due to high pathogenicity avian influenza. The top image is the 1983 outbreak in the United States that resulted in the depopulation of 17 million birds and indirect expenses totaling $250 million dollars. The bottom illustration depicts the 1999-2000 outbreak in Italy that cost $100 million (USD) to eradicate approximately 18 million birds. Indirect costs totaled $500 million (USD). *Graphic illustration by: Clint May, Iowa State University*

(Bottom) This graphic illustrates how H5N1 emerged in Southeast Asia and has spread to Europe, the Middle East, the Pacific and Egypt in Africa. *Graphic illustration by: Dani Ausen, Iowa State University*

Page 7 This graphic illustrates the various routes of transmission regarding END and HPAI. The top image depicts a chicken having direct contact with another chicken as well as secreting the virus in its feces where other birds could ingest it and become exposed. The middle image depicts fomite transmission when a person steps in feces shed by a duck and then carries it on his shoes to another area where other waterfowl could then become exposed. The bottom image depicts waterfowl sharing a pond and shedding the virus in their feces so that other birds become exposed. There is also a bird on the shore that is secreting the virus in their respiratory secretions which can then be aerosolized exposing other birds. *Graphic illustration by: Clint May, Iowa State University*

Page 8 The photos depict the clinical signs of either HPAI or END in poultry. *Graphic illustration by: Dani Ausen, Iowa State University; Photo sources: Plum Island Animal Disease Center (A, B, C, D, E, and F); USDA (G and H)*

Page 9 The photos depict the clinical signs of either HPAI or END in pet birds. *Graphic illustration by: Dani Ausen, Iowa State University; Photo sources: USDA (A, B, C and E); Travis Engelhaupt, Iowa State University (D)*

Page 11 Photo of the supplies used by a Foreign Animal Disease Diagnostician (FADD) when preparing to collect samples from birds for HPAI or END. *Photo source: Danelle Bickett-Weddle, Iowa State University*

Page 12 This graphic depicts the various effective disinfectants for END and HPAI. *Graphic illustration by: Katlyn Harvey, Iowa State University*

Page 13 A parrot showing ruffled feathers. *Photo source: USDA National Veterinary Services Laboratories*

Page 14 ***(Top)*** This graphic depicts Mr. Jones calling you on the phone to update you on the birds status. *Graphic illustration by: Clint May, Iowa State University*

(Bottom) This graphic depicts a female veterinarian examining a bird lying on its side on newspaper on the examination table. *Graphic illustration by: Clint May and Travis Engelhaupt, Iowa State University*

Page 15 The "Of a Feather" bird shop was quarantined after END was diagnosed. *Graphic illustration by: Andrew Kingsbury, Iowa State University*

Knowledge Review Answers

Knowledge Review #1

Which of the following are true statements about avian influenza or Newcastle disease viruses? Select <u>all</u> correct statements.

- **A.** Newcastle disease infections in birds will always result in severe illness and high mortality rates.
- **B.** Newcastle disease pathotypes are classified based on their virulence in chickens.
- **C.** Avian influenza infections in birds will always result in severe illness and high mortality rates.
- **D.** Influenza A viruses are classified into subtypes based on two surface antigens, the hemagglutinin (H) and neuraminidase (N) proteins.
- **E.** There are virulent forms of avian influenza and Newcastle disease that have public health consequences.

The correct answers are: B, D, and E. B) There are 3 pathotypes of Newcastle disease APMV-1 based on the virulence in chickens – lentogenic, mesogenic and velogenic; D) Avian influenza has 16 identified hemagglutinin proteins (H1 to H16) and nine identified neuraminidase proteins (N1 to N9); and E) High pathogenicity avian influenza and exotic Newcastle disease viruses are both zoonotic disease concerns with public health consequences. A and C are incorrect because Newcastle disease and avian influenza infections can range from subclinical to less virulent forms which cause clinical illness, but are not highly pathogenic to highly virulent causing death in chickens.

Knowledge Review #2

Which of the following are immediate economic impacts associated with an outbreak of HPAI or END? Select <u>ALL</u> that apply.

- **A.** Costs associated with depopulating and disposing of animals.
- **B.** Costs associated with indemnifying owners.
- **C.** Cost of increased disease surveillance.
- **D.** Reduced ability to export poultry and poultry products.
- **E.** Higher prices for domestic poultry products.
- **F.** Higher prices for poultry products in other countries.

The correct answers are A, B, C, D and F. E is incorrect because if exports of poultry products cease, the domestic supply will exceed demand and prices in the U.S. will drop. An extreme long term shortage could cause prices to increase domestically, but this is not anticipated as an immediate economic impact.

Knowledge Review #3

Select all possible differentials based on the information presented.

- **A.** Aspergillosis
- **B.** Avian Chlamydiosis
- **C.** Calcium Deficiency
- **D.** Encephalomalacia
- **E.** Exotic Newcastle Disease
- **F.** High Pathogenicity Avian Influenza
- **G.** Lead Toxicity
- **H.** Pacheco's Disease
- **I.** Parasitism
- **J.** Salmonellosis
- **K.** Systemic Organ Disease

The correct answer is all of the above. Given the information available, all of these conditions should be included until more tests can be performed to help narrow this list.

Knowledge Review #4

What is the recommended period of time to quarantine newly purchased or acquired birds?

- **A.** 7 days
- **B.** 14 days
- **C.** 21 days
- **D.** 30 days

The correct answer is D, 30 days, at least, to quarantine newly introduced (purchased or acquired) birds.

Knowledge Review #5

After examining this second sick bird, you take a moment to go over what is known about this case. The disease appears to be spreading throughout the bird shop, the birds were acquired illegally, and one has already died. What should your next step be?

- **A.** Ask Mr. Jones to leave the birds with you for the day so you can catch up on the rest of your appointments
- **B.** Necropsy the bird and prepare tissue samples for shipment to the closest diagnostic laboratory.
- **C.** Contact your state or federal animal health official immediately.
- **D.** Go home for lunch so that you can research this more and contemplate it further.

The correct answer is C, Contact your state or federal veterinarian immediately. This case has the look and feel of something more serious and you must address it immediately. This could very well be a foreign animal disease, which warrants further investigation. Cancel your appointments and contact your state and/or federal animal health official immediately. They will enlist the services of a Foreign Animal Disease Diagnostician (FADD) who will collect and submit the samples to the appropriate diagnostic laboratory.

Knowledge Review #6

Your clinic, as well as Mr. Jones' pet bird shop, are contaminated and serve as potential sites for the spread of END. It is likely that the State Animal Health Official will enforce a quarantine on the sites until they can be properly cleaned and disinfected. What disinfectants would be effective in this process? Select ALL that apply.

- **A.** Soap and water
- **B.** Chlorhexidine (Nolvasan® S)
- **C.** Quaternary ammonium compounds (Roccal®-D Plus)
- **D.** Oxidizing agents (Virkon® S)
- **E.** Sodium hypochlorite 6% (bleach)

The correct answers are B, C, D, and E. Disinfectants such as Nolvasan® S, Roccal®-D Plus, Virkon® S, and 6% bleach would ALL be effective in the disinfectant process, after the organic matter has been cleaned up. Soap and water should be used in the cleaning process but is NOT a disinfectant.

Knowledge Review #7

You remember that Jason, Mr. Jones' former employee has backyard chickens and discover that they have a family friend who works for a local poultry operation. You have also heard that illegal cock fighting goes on in the county. What course of action should you take?

- **A.** Talk to Mr. Jones and get Jason's contact information to inform him of the risk.
- **B.** Contact all of your bird clients and inform them of the disease risk.
- **C.** Share this information with the state and/or federal animal health official.

The correct answer is C, Share this information with the state and/or federal animal health official. The investigators will handle the communication details with Mr. Jones, Jason, his family friend, and alert other bird owners in the area if they feel it is necessary.

Exotic Newcastle Disease and High Pathogenicity Avian Influenza Reference Chart

	Exotic Newcastle Disease (END)	High Pathogenicity Avian Influenza (HPAI)
Importance	Highly contagious, often fatal disease	
Organism	Avian paramyxovirus-1	Type A Influenza virus, *Orthomyxovirus* Classified by surface antigens H and N
Clinical Signs in Birds	**END AND HPAI ARE CLINICALLY INDISTINGUISHABLE FROM EACH OTHER** Depression, edema, decreased egg production, thin-shelled eggs Decreased feed and water consumption; Sudden death **Respiratory:** Coughing, sneezing, nasal discharge, dyspnea, cyanosis **Digestive:** Watery diarrhea Nervous: Ataxia, torticollis, paresis, or paralysis **Hemorrhagic:** Subcutanous petechiae and ecchymoses, blood-tinged oral & nasal discharges	
Clinical Signs in Humans	Mild conjunctitvitis; Possibility of more severe signs in the immunosuppressed	Mild to fatal disease
Transmission	Spread by feces and respiratory secretions, via inhalation or ingestion. Can be transmitted on fomites.	
Differential Diagnosis	**Poultry:** HPAI, END, fowl cholera, infectious coryza, fowl pox, avian chlamydiosis, infectious laryngotracheitis, mycoplasmosis, infectious bronchitis, fowl typhoid, severe parasitism, calcium deficiency, management problems, toxins. **Psittacines:** Avian chlamydiosis, Pacheco's disease, salmonellosis, toxicosis.	
Morbidity/ Mortality	Morbidity can reach 100% Mortality can reach 100%	
Diagnosis	Virus isolation required for definitive diagnosis	
Sample Collection	**Before collecting or sending any samples, the proper authorities should be contacted. Samples should be sent under secure conditions to authorized laboratories to prevent spread.**	
Preferred Samples	Tracheal, choanal cleft or cloacal swab from live or dead birds, as well as feces	
Notification	**State & federal animal health authorities should be contacted IMMEDIATELY and informed of suspicions**	
Quarantine	**SUSPECTED ANIMALS, AREAS, FARMS WILL BE QUARANTINED BY STATE ANIMAL HEALTH OFFICIAL**	
Vaccination	Lentogenic strain routine in poultry flocks. Decreases viral shedding but does not prevent infection.	Decision to vaccinate is made at the USDA level. Decreases viral shedding but does not prevent infection.
Disinfection	Sodium hypochlorite (6%), phenolics (e.g., One-Stroke Environ®), oxidizing agents (e.g., Virkon® S) and quaternary ammonium compounds (e.g., Roccal®-D Plus)	
	Inactivated by heating to 133˚F for 3 hours or 140˚F for 30 minutes; pH = 3 inactivates; Formalin – efficacy is temperature dependent; Chlorhexidine (Nolvasan® S), ether	Inactivated by heating to 133˚F for 60 minutes; pH = 2 inactivates; Aldehydes (formalin, gluteraldehyde, formaldehyde); 70% ethanol, povidone-iodine, lipid solvents

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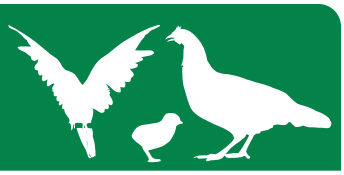
Exotic Newcastle Disease (END) Disease Brief



Importance and Etiology

Newcastle disease viruses (NDV) are a heterogeneous group of viruses that can cause a variety of syndromes in poultry, from asymptomatic infections to severe disease. These viruses comprise the serotype avian paramyxovirus-1 (APMV-1) of the genus *Avulavirus*; APMV-1 is a synonym for NDV. Strains of APMV-1 are divided into three pathotypes, based on their virulence in chickens. Lentogenic strains are the least virulent, mesogenic strains are moderately virulent, and velogenic strains are the most virulent. The velogenic viruses can also be subdivided into a neurotropic form, which is typically associated with respiratory and neurologic signs, and a viscerotropic form with hemorrhagic intestinal lesions. These clinical forms overlap and are rarely clear-cut.

Many or most species of birds are probably susceptible to infection with APMV-1, but only some species become ill. Chickens are particularly susceptible to disease. Velogenic isolates of APMV-1 cause severe illness in chickens, with morbidity and mortality rates as high as 100%. Some velogenic strains can also affect other species of domesticated and wild birds. Turkeys are generally less susceptible to disease than chickens, and waterfowl (ducks and geese) tend not to develop clinical signs with most isolates. Some pet birds and wild birds can also become ill or die.

Lentogenic isolates of APMV-1, which cause asymptomatic infections or mild respiratory disease in poultry, are found worldwide. Waterfowl may be their natural reservoir hosts. Mesogenic strains can cause acute respiratory disease and neurologic signs in some poultry, but the mortality rate is usually low. Lentogenic and mesogenic strains can produce more severe clinical signs, if the flock is co-infected with other pathogens. There is also some evidence that lentogenic strains can evolve to become velogenic. Lentogenic and mesogenic viruses can be found in the U.S.; lentogenic strains are the most common.

There is more than one test to determine the pathogenicity of an APMV-1 isolate, and countries may use different criteria to define Newcastle disease. The U.S. defines **exotic Newcastle disease (END)** as the disease caused by velogenic viscerotropic strains of APMV-1. The OIE defines **Newcastle disease** as the disease caused by **highly virulent APMV-1 viruses**–those viruses that 1) have an intracerebral pathogenicity index of at least 0.7, OR 2) contain specified genetic sequences that have been linked to virulence. Highly virulent APMV-1 must be reported to the OIE and have serious repercussions for international trade. Less virulent viruses do not have trade repercussions.

Poultry in the U.S. are free of highly virulent APMV-1, but outbreaks occur periodically from introduced viruses. These outbreaks can have a severe economic impact. An outbreak in southern California in 2002/2003 cost more than $160 million to fight and resulted in the natural death or culling of more than 3 million birds.

Vaccination

Poultry flocks are routinely vaccinated for Newcastle disease. While vaccination reduces the severity of disease, it does not prevent infection and virus shedding.

Transmission

Infected birds shed APMV-1 in feces and respiratory secretions. Most birds become infected by inhaling or ingesting the virus. APMV-1 is transmitted readily on **fomites**, such as shoes and equipment used by vaccination and debeaking crews. Virus is present in all tissues of infected birds, and raptors have become ill after being fed contaminated carcasses. Egg-associated transmission is possible; however, velogenic strains are probably not transmitted often by this route because these strains usually kill the embryo.

Chickens generally become infected by exposure to other poultry, but they can also acquire velogenic viruses from cormorants, gulls or psittacine birds. These birds may or may not have clinical signs. Legally imported psittacine birds are quarantined and tested, but illegally imported birds are a threat.

The incubation period is commonly 2-15 days in chickens.

Clinical Signs

Virulent Newcastle disease is a systemic disease that affects tissues throughout the body. Some birds die suddenly, without other clinical signs. Birds that survive longer can have respiratory signs (nasal discharge, coughing, sneezing, dyspnea), watery diarrhea and neurological signs such as ataxia, circling, torticollis, and paresis or paralysis of the wings and/or legs. Neurologic signs can appear concurrently with other clinical signs, but often develop later. Inappetence, depression, ruffling of the feathers, and swelling of the tissues of the head and neck are also common. Conjunctival reddening and edema may be an early sign in some birds. Egg laying often drops dramatically, and the eggs may be soft-shelled

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or misshapen. Production records may show that water and feed consumption has decreased in the flock. Highly virulent APMV-1 viruses can affect some poultry species (particularly chickens) severely while other species remain unaffected or mildly affected.

Highly virulent APMV-1 viruses do not cause a single, distinct syndrome and none of these clinical signs can be relied upon to diagnose this disease. The clinical signs that predominate in each outbreak may be different. It is best to maintain a high index of suspicion with any highly virulent disease that could be consistent with END.

Hemorrhagic, necrotic or ulcerated lesions of the gastrointestinal tract, centered around the lymphoid tissues of the intestinal wall (including Peyer's patches), raise the index of suspicion for END. Whenever possible, several carcasses should be examined.

Differential Diagnosis

Other severe, systemic diseases of poultry with respiratory or neurologic signs can look similar to virulent Newcastle disease. Fowl cholera, highly pathogenic avian influenza (HPAI), fowl typhoid, infectious laryngotracheitis, fowl pox (diphtheritic form), avian chlamydiosis, mycoplasmosis, infectious bronchitis, severe parasitism and toxins, as well as management problems such as water or feed deprivation and heat exhaustion, are among the considerations.

In pet birds, other diseases to consider include HPAI, psittacosis, Pacheco's disease, salmonellosis, adenovirus infections, nutritional deficiencies, toxins and other paramyxovirus infections.

Diagnosis

Definitive diagnosis requires virus isolation and identification in the laboratory. Tracheal and cloacal swabs (or feces) may be used for identification of the agent in live birds. Tissue samples, oronasal swabs and feces (or intestinal contents) may be collected from dead birds.

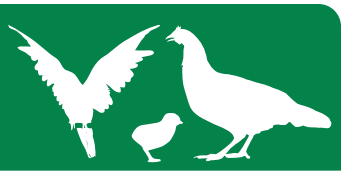
Disinfection

APMV-1 can survive for long periods in some environments but is rapidly destroyed by dehydration and ultraviolet rays in sunlight. This virus can also be killed by pH extremes, heat and detergents. Effective disinfectants include phenols (e.g., One Stroke Environ®), oxidizing agents (e.g., Virkon®), halogens (e.g., 6% household bleach), biguanides (e.g., Novalsan®-S) and quaternary ammonium compounds (e.g., Roccal®-D Plus).

Recommended actions if END is suspected

Contact State and Federal veterinarians immediately.

Avian Influenza Disease Brief



Importance

Avian influenza (AI) viruses are extremely heterogeneous. These viruses are classified into low pathogenic avian influenza (LPAI) strains, which usually cause mild illness or subclinical infections in poultry, and highly pathogenic avian influenza (HPAI) viruses, which cause serious disease with morbidity and mortality rates approaching 100%.

Two surface antigens, the hemagglutinin (H) and neuraminidase (N) proteins, are used to classify AI viruses into subtypes. LPAI can be caused by viruses carrying any hemagglutinin, from H1 to H16. Some H5 and H7 LPAI viruses can mutate to become HPAI viruses.

All HPAI viruses must be reported to the OIE and have serious repercussions for international trade. H5 and H7 LPAI viruses must also be reported and can affect international trade.

AI is a zoonotic disease. Although most HPAI viruses have been associated with conjunctivitis or mild, influenza-like disease in people, some viruses are capable of causing severe or fatal illness. Some LPAI viruses (particularly H9 viruses) can also infect humans, but these viruses seem to cause only mild disease (indistinguishable from human influenza) or asymptomatic infections. Human infection with AI viruses occurs mainly after close contact with poultry.

H5N1 HPAI viruses are a serious concern. These viruses emerged in Asia in 1997, and have caused outbreaks in poultry throughout Asia, as well as in Europe, Africa and the Middle East. They seem to have an unusually broad host range and have caused illness or deaths in humans, tigers, leopards, housecats, dogs, palm civets and stone martens. The most significant HPAI outbreak affecting humans to date began in 2003. H5N1 emerged in Southeast Asia and as of December 29, 2010, 512 confirmed human cases had been reported to the World Health Organization; 304 of these cases were fatal. Deaths have also been reported in wild birds, which usually carry avian influenza viruses asymptomatically. H5N1 HPAI viruses have become endemic in some Asian countries and Eqypt. These H5N1 viruses continue to emerge in new outbreaks each year, and complete eradication in the near future is unlikely.

Vaccination

The decision to vaccinate for HPAI is made at the USDA level by the Chief Veterinary Officer. The decision is based on the scope of the disease, resources available, and in consultation with other Federal agencies, state animal health officials, industry, and university experts as necessary. Vaccinating decreases viral shedding but does not prevent infection.

Transmission

LPAI viruses are widespread in wild birds; waterfowl and shorebirds seem to be the natural reservoir hosts for these viruses. If LPAI viruses spread to poultry, they can mutate to become HPAI viruses. It is very unusual to find HPAI viruses in wild birds.

AI viruses can enter the body by inhalation, ingestion or through other mucous membranes such as the conjunctiva. Feces, saliva and respiratory secretions from infected birds contain large amounts of virus. HPAI viruses can also be found in poultry meat and eggs, but LPAI viruses do not seem to occur in meat. On a farm, AI viruses can spread between birds in aerosols (when birds are in close contact) and by the fecal/oral route. Between farms, AI viruses can be spread readily on fomites.

The incubation period is 1-14 days. More virulent HPAI viruses typically kill birds within a few days of exposure.

Clinical Signs - HPAI

Highly pathogenic avian influenza is a systemic disease affecting many tissues. Some birds die suddenly, without other clinical signs and with few or no lesions at necropsy. Birds that survive longer can have respiratory signs (nasal discharge, coughing, sneezing, dyspnea), watery diarrhea and neurological signs such as ataxia and torticollis. Affected birds are usually severely depressed and inappetent, with ruffled feathers. Some birds have swelling or cyanosis of the head, comb, wattles or legs, and the skin may darken from subcutaneous hemorrhages. Egg laying often drops dramatically, and the eggs may be soft-shelled or misshapen. Production records may show that water and feed consumption has decreased in the flock. HPAI viruses can affect some species severely while other species remain unaffected or mildly affected.

HPAI viruses do not cause a single, distinct syndrome and none of these clinical signs can be relied upon to diagnose this disease. The clinical signs that predominate in each outbreak may be different. It is best to maintain a high index of suspicion with any highly virulent disease that could be consistent with HPAI.

Clinical Signs - LPAI

LPAI viruses usually cause subclinical infections, mild respiratory disease or production losses such as decreased

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egg production and decreased feed consumption. More severe disease can be seen if the birds are co-infected with other pathogens.

Differential Diagnosis

Other severe, systemic diseases of poultry with respiratory, neurologic or hemorrhagic signs can look similar to HPAI. Exotic Newcastle disease, fowl cholera, fowl typhoid, infectious laryngotracheitis, infectious bronchitis, severe parasitism, heat exhaustion and toxins are among the considerations.

LPAI, which can cause a wide range of syndromes from asymptomatic infection to severe disease (when birds are co-infected with other pathogens), can resemble many poultry diseases.

Diagnosis

Definitive diagnosis requires virus isolation and identification in the laboratory. Tracheal, choanal cleft or cloacal swabs from live or dead birds, organ samples from dead birds, and feces can be submitted.

Disinfection

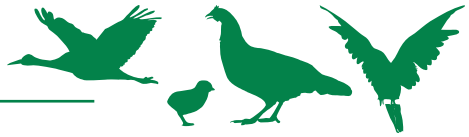
Avian influenza viruses are inactivated by extremes in pH, heat, and dryness. They are also susceptible to many disinfectants including hypochlorite (bleach), 70% ethanol and other agents. In the presence of organic matter, AI virus can be inactivated by aldehydes. After removal of organic matter, effective classes of disinfectants include phenolics (e.g., One Stroke Environ®), quaternary ammonium compounds (e.g., Roccal®), oxidizing agents (e.g., Virkon®), and dilute acids (e.g., peracetic acid).

Recommended actions if HPAI is suspected

Contact State and Federal veterinarians immediately.

HPAI, END Differentials - Reportable and Diagnostics

In All Avian Species



Avian chlamydiosis is caused by *Chlamydophila* (formerly *Chlamydia*) *psittaci*, a gram negative, intracellular bacterial parasite that can occur in most species of birds. In humans, infection with *Chlamydophila* is called psittacosis; infection in birds is termed avian chlamydiosis. Clinical signs in poultry can include depression, ruffled feathers, weakness, anorexia, respiratory distress, diarrhea, conjunctivitis, and decreased egg production. In pet birds, common signs include anorexia, weight loss, diarrhea, respiratory distress, central nervous system signs, and conjunctivitis. Diagnostic tests include CBC, chemistry panel, radiographs, impression smears with staining, immunohistochemistry, ELISA, and PCR. This is a zoonotic and an OIE Reportable Disease - contact your State Animal Health Official.

Calcium deficiency is most common in young birds. It is of uncertain etiology; however, affected birds are often on diets deficient in calcium, phosphorus or vitamin D3. Clinical signs include seizures, ataxia, opisthotonos, weakness or tetany. In adults, osteoporosis and reduced egg shell quality occur. Diagnostic tests include CBC and chemistry panel.

Encephalomalacia is a nutritional disease caused by deficiencies of vitamin E and selenium in the diet. It can cause a wide variety of clinical signs in birds of all ages including ataxia, head tilt, poor digestion, lethargy or hyperactivity, tremors, incoordination and recumbency. Diagnostic tests include a necropsy with histopathology of the brain.

Severe parasitism Birds can become infected with a variety of internal and external parasites and protozoa including ascarids, cestodes, *Cryptosporidium* spp., coccidia, *Toxoplasma* spp., and trematodes. Generalized signs of parasitism can include anorexia, weight loss, diarrhea, vomiting, dehydration, central nervous system signs (*Baylisascaris procyonis*), coughing and dyspnea (cryptosporidiosis), paralysis and blindness (toxoplasmosis). Diagnostic tests include fecal smear or float or identifying in tissue(s). Some parasites carry zoonotic diseases; screwworms are a foreign animal and an OIE Reportable Disease.

Salmonellosis In pet birds, infection with the bacteria *Salmonella* spp. can lead to acute disease with nonspecific signs including lethargy, anorexia, polydipsia, polyuria, and diarrhea. In chronic cases, central nervous system signs, arthritis, dyspnea and indications of liver, spleen, kidney, or heart damage are common. With high dose infections, conjunctivitis may occur. Free-ranging birds can be subclinical carriers. Diagnostic tests include serology and bacteriology to identify the organism. This is a zoonotic disease and may be reportable in some states - contact your State Animal Health Official.

Toxicosis Lead and zinc intoxication are two of the most common and clinically recognized poisonings of companion birds and captive and free-ranging birds. The precise cause of lead intoxication in many cases is undetermined. The precise source of exposure may be undetermined in many cases. Clinical signs may include lethargy, depression, anorexia, weakness (wing droop, leg paresis), diarrhea, ataxia, head tilt or tremors, blindness, circling, paresis, paralysis, convulsions and death. Some birds may die without clinical signs. Diagnostic tests include CBC/chemistry panel, radiographs and serum lead and zinc levels.

In Psitticines

Aspergillosis is a common cause of opportunistic respiratory disease in companion birds caused by the bacteria *Aspergillus* spp. Susceptibility increases with stress, poor management, use of antibiotics or steroids, respiratory irritants, and concomitant disease. Clinical signs include weight loss, depression, respiratory distress, and occasionally neuromuscular abnormalities. In acute overwhelming infections, dyspnea or sudden death is observed. Diagnostic tests include CBC and chemistry panel, radiographs, cytology, swabs from cloaca/choanal/oropharyngeal/conjunctiva/fecal, immunohistochemistry, ELISA, or PCR. This disease is zoonotic.

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Pacheco's disease is a herpesvirus affecting only psittacine birds. Asymptomatic carriers exist and may shed virus in their feces when stressed. The most common clinical sign is sudden death or death after a very brief illness in birds in excellent body condition. Clinical signs can consist of lethargy, depression, anorexia, diarrhea, conjunctivitis, and central nervous system signs including tremors, ataxia, opisthotonos, and seizures. Diagnostic tests include CBC, serum electrophoresis, cytology, and fungal culture.

In Poultry

Fowl cholera is a contagious bacterial disease of domesticated and wild avian species. It is caused by infection with *Pasteurella multocida*. A fulminating bacteremia with high morbidity and mortality often results. Acute disease can result in fever, anorexia, ruffled feathers, diarrhea, increased respiratory rate and sudden death. Chronic forms of the disease cause localized infections of the skeletal system. Diagnostic tests include blood smear and culture. Certain strains of fowl cholera are reportable to OIE - contact your State Animal Health Official.

Fowl pox is a relatively slow spreading viral infection caused by an avipoxvirus and is found throughout the world. It affects chickens, turkeys and other domestic fowl. The virus can survive in dried scabs and for months on contaminated premises under certain conditions. There are two common forms of fowl pox, referred to as the *dry* and *wet* (or diphtheritic) forms. The **dry form** is characterized by the presence of scab-like lesions on the skin; this form is not a differential for END/HPAI. In the **wet form**, the lesions are seen on mucosal surfaces, such as the conjunctiva of the eye, nasal passages, oral and pharyngeal mucosa, and the mucosa of the trachea. The wet form is more severe clinically, causing interference with eating or breathing and resulting in death due to asphyxiation when the trachea is affected. Diagnostic tests include histopathology, tissue smear, virus isolation, and PCR.

Infectious coryza is caused by the bacterium *Avibacterium* (formerly *Haemophilus*) *paragallinarum*, which primarily attacks the upper respiratory system and nasal passages. It primarily affects chickens causing swelling of the face, wheezing, sneezing, nasal discharge, conjunctivitis and open-mouth breathing. Infectious coryza can be acute or chronic in nature. The acute cases spread rapidly and death can occur within hours to days of the first signs. Chronic carriers serve as reservoirs of infection for poultry flocks. Diagnostic tests include bacteriology to identify the catalase-negative organism and PCR.

Infectious laryngotracheitis (ILT) is an acute respiratory disease caused by a herpesvirus. It primarily affects chickens but can also occur in turkeys and game birds. The virus can survive for long periods in recovered birds and in the environment. Signs can vary from a mild respiratory disease to the sudden occurrence of gasping, swollen watery eyes, coughing, wheezing, expulsion of blood from the mouth and nostrils, head shaking, elevated mortality, reduced feed consumption, and decreased egg production. Diagnostic tests include necropsy with blood/mucus/caseous exudate or hollow cast in trachea, virus isolation, tissue culture, histopathology, and PCR. Certain strains of ILT are reportable to OIE - contact your State Animal Health Official.

Mycoplasmosis Several *Mycoplasma* species have been isolated from avian hosts. The most important are *Mycoplasma gallisepticum*, *M. synoviae*, *M. meleagridis* and *M. iowae*. *Mycoplasmas* are a group of microorganisms that are half way between bacteria and viruses, in that they have some of the properties of each. *M. gallisepticum* causes disease in chickens, turkeys, gamebirds and house finches. *Mycoplasmas* are associated with infections of the respiratory, joint, and reproductive systems and clinical signs can mimic signs of HPAI or END. Diagnostic tests include ELISA, isolation and identification, PCR or hemagluttination-inhibition. Certain strains of *M. gallisepticum* are reportable to OIE - contact your State Animal Health Official.

Infectious bronchitis (IB) is an acute, highly contagious viral respiratory disease of chickens, caused by a coronavirus. It is characterized by respiratory signs (e.g., coughing and sneezing), drop in egg production, decreased egg quality, nephritis, and morbidity. Mortality rates can reach 40% in chickens less than three-weeks old, but over five-weeks, it is less significant. Diagnostic tests include clinical history, seroconversion or rising viral antibody titers, hemagluttination inhibition test, and virus isolation. Certain strains of IB are reportable to OIE - contact your State Animal Health Official.

Low pathogenicity avian influenza (LPAI) viruses usually cause inapparent infections or mild disease; more severe illness can occur in birds that are co-infected with other pathogens. Diagnostic tests include virus isolation, PCR, agar gel immunodiffusion (AGID), and serology. This is a zoonotic and an OIE Reportable Disease - contact your State Animal Health Official.

Management problems such as deprivation of water or feed, and poor ventilation.